Combustion Technology: Utility Perspectives on Research and Development Needs

William Guyker
Allegheny Energy Supply
Monroeville, PA

Allegheny Energy Supply
an Allegheny Energy company

About Allegheny Energy

- 125 year old company – began supplying power in 1883
- Two Core businesses: Allegheny Energy Supply and Allegheny Power
- Over 1.7 million customers for electricity
- Generation mix includes
  - Coal [65.4%]
  - Natural gas [24.8%]
  - Oil [1.3%]
  - Hydro and pumped storage [8.4%]

Allegheny Energy Supply
an Allegheny Energy company

Allegheny Energy

- Supplies customers in
  - Pennsylvania
  - West Virginia
  - Maryland
  - Virginia
  - Ohio
- Generation Locations
  - Pennsylvania
  - West Virginia
  - Maryland
  - Virginia
  - Tennessee
  - Indiana
  - Illinois

Allegheny Energy Supply
an Allegheny Energy company

Allegheny Energy Supply and Deregulation

- Over 12,000 MWe of total generation capacity (as of Dec 31, 2001) including 12 stations with coal-fired capacity
- Over 9,900 MW of capacity is unregulated/deregulated
- About 2,100 MW of capacity is regulated
- Coal Boilers are a mix of wall, tangential, cell,vertical and cyclone boiler types

Allegheny Energy Supply
an Allegheny Energy company

Allegheny Reflects Competitive Conditions Throughout Utility Industry

- Faced with competition and state-based deregulation
  - Generation competition
    - Most plants are now merchant plants
    - Must compete in marketplace
  - Supplier competition for retail customers
  - Default Service is provided by Allegheny Power
  - Special requirements (e.g.,portfolio standards, system benefits charges)
- Faced with competitors who did not invest in R&D, but capitalized on utility R&D (IPP's, NUG's)

Allegheny Energy Supply
an Allegheny Energy company

Allegheny Reflects Regulatory Conditions Throughout Utility Industry

- Increased environmental regulations
  - NO_x regulations
  - Multi-pollutant regulations (NO_x, SO_2, mercury, CO2,other)
- Periodic conflicts between Federal and state regulators

Allegheny Energy Supply
an Allegheny Energy company

Allegheny Reflects Business Conditions Throughout Utility Industry

- Fleet of coal-fired stations is getting older (20 – 50 year old boilers)
  - No longer burning original spec coal
  - Burning least cost fuels—including fuel blends and opportunity fuels
- No longer putting generation costs in rate base
- Faced with investor skepticism due to financial market news – less money available for projects.
- Fuel adjustment clauses- saving or losing money on fuel no longer flows to the customer

Allegheny Energy Supply
an Allegheny Energy company

Summary of Utility Conditions

- Competition to generate and supply power
- Generating while a capacity surplus remains
- Generating with competitive fuels in a tight market environment
- Can’t recover all research costs in rate base
- Less money available for R&D

Allegheny Energy Supply
an Allegheny Energy company

Utility Conditions - 2

- Reduced investment in R&D
  - Much less collaborative research, and total research, due to competition
- Less emphasis on doing things “because it is the right thing to do” – loss of rate base coverage
- Industry now has large debt and financial difficulties,no longer BAU,simply survival and expectation of major cost cutting measures, reduced staffs, little to no new construction unless absolutely necessary
- Focus on existing Asset Optimization and Risk Management

Allegheny Energy Supply
an Allegheny Energy company

Government/Academic R&D Needs and Opportunities

- Now operating generating stations in "tighter" fashion
  - Emphasis on efficiency and emissions
  - Less tolerance for error
- Need research that facilitates better operation and maintenance of existing plants as well as breakthroughs on new generating technologies

Allegheny Energy Supply
an Allegheny Energy company

Requirements for Academic Programs

- Get closer to the generating stations
  - Be there, go there
  - Seek practical results in response to real problems
  - Don't get in the way of operations while working there
- In university laboratories
  - Develop larger test facilities
  - Develop results that readily adapt to full scale operations
  - Develop results in response to industry/generating station problems

Allegheny Energy Supply
an Allegheny Energy company

Examples of Good Programs

- Outreach to generating stations and industry
  - Pennsylvania State University Energy Institute
  - Lehigh University Energy Research Center

- Large scale test facilities
  - University of Utah [e.g., L-1500 test furnace for pulverized coal, fluidized bed furnace, stoker boiler]

Allegheny Energy Supply
an Allegheny Energy company

Opportunities for Universities

- Collaboration with vendors – large scale test facilities and programs
  - Advanced Combustion Engineering Research Center (ACERC) of University of Utah and Brigham Young University is an example with great potential
- Experimentation with scalable results
- Students working in power plant environments on research

Allegheny Energy Supply
an Allegheny Energy company

Opportunities for Universities

- Focus more on experimentation – particularly large-scale experimentation
- Use modeling as a tool, and not as the focus of all activities
  - Make modeling practical
  - Develop and ensure experimental and field to model relationships

Allegheny Energy Supply
an Allegheny Energy company

Opportunities for Universities

- Modeling
  - Separate explanatory modeling from predictive modeling
    - Focus on getting explanatory modeling reasonably precise
    - Develop predictive modeling based upon field test results – and remain tied to full scale results
- Modeling is only one tool: others need to be developed
- Make sure modeling is real, and results are readily usable in commercial practice
- Examples include: CFD,Optimization,Simulation/Emulation,ANN

Allegheny Energy Supply
an Allegheny Energy company

Opportunities for Universities

- Focus research on shorter term gains
- Understand that Utility Focus is on Financial Performance in the next Quarter
- If doing fundamental research
  - Develop links between fundamental research and full scale applications
  - Show relationships and how industry can use the fundamental research results
  - Develop a Commercialization Model

Allegheny Energy Supply
an Allegheny Energy company

Issues to Consider

- Conflicting agendas
  - e.g., confidentiality of results [for industry] vs need to publish [for universities]
  - e.g., criticality of budgets and schedules [for industry] vs investigations into new and uncharted areas of interest [for universities]
  - e.g., student time allocation is first to studies, then to solving industry problems vs need for results
- Conflicting time horizons [shorter for industry than academia]
- Potential for project failure

Allegheny Energy Supply
an Allegheny Energy company

Conclusion

- Optimal division of responsibilities: industry, government, academia:
- Industry – defines the problems to be addressed, provides some seed money for research, needs a business plan or model
- Government – provides bulk of research funding and project management skills consistent with national policies; provides links between industry and academia
- Academia – provides bulk of researchers to address problems, linked with industry and government personnel:

Allegheny Energy Supply
an Allegheny Energy company